

# Fires, Explosions and Toxic Releases: Implications for Post 9-11 Training

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Gerald V. Poje, Ph.D.

Board Member



Training From the Inside Out NIEHS-WETP Meeting

Research Triangle Park, NC

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# Independent Federal Agency

- Five member Board appointed by President and Senate for 5 year terms
- Jointly responsive to Congress and President
- Began operations de novo in 1998
- Funding \$8 M; staff 35+
- Mission to investigate and promote the prevention of major chemical accidents at fixed facilities
- Subpoena power; recommendation emphasis
- Emphasis on accidents that affect or could potentially affect the public
- Safety Studies are a priority (reactive hazards, dust explosions)



# April 16, 1947 Texas City, TX

## Key Facts

- 600 killed; 3500 injured
- $\text{NH}_4\text{NO}_3$  ship explosions
- extensive damages at other facilities from initial blast
- safety/technology transfer issues



Grande Camp Explosion



# December 2-3, 1984 Bhopal, India

## Key Facts

- 6000 killed; 300,000 injured
- runaway reaction  
MIC and HCN
- multinational corporation
- design,  
intermediate  
storage, mechanical  
integrity, staffing
- policy stimulus



Union Carbide, India





# U.S. Chemical Accidents

Profile: 5-Yr data (1994-99) on EPA RMP\* Processes:

~15000 reporting facilities

» 1900 accidents

33 deaths; ~ 1900 injuries

> 200,000 civil evacuations or shelterings

- Insurance firms pay out ~ \$1B/yr to cover firm's US losses
- Total accident losses by chemical firms is ~ \$3-5 B/yr

\* only one of 20+ CSB investigations involve RMP processes

# Basic Scope of Existing Chemical Incident Data Sources



## FIXED FACILITIES

## TRANSPORTATION

Heavy Hydrocarbon

Light Hydrocarbon

Toxic

Flammable

Reactive

CPSC

Residential

Agriculture

Small Business

Government

Heavy Industry

Offshore Platforms

Pipelines

Air

Rail Roads

Highway

Water

No Consequences

Chemical Not Listed

RMP

ARIP

Stored Below TQ

MMS

INTRA STATE

OPS

HMIS

COAST GUARD

ATSDR

36 STATES

Scope of this Report

Source: Dr. Sam Mannan, MKOPSC

"Holes"

NO DATA IS AVAILABLE

# Under Reporting due to Low Quantity Storage

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- Hydrogen Sulfide  
(RMP 19 incidents in 5 years vs.  
HSEES 70 incidents in 1 year)
- Sulfur Dioxide  
(RMP 48 incidents in 5 years vs.  
HSEES 494 incidents in 1 year)

Source: Dr. Sam Mannan, MKOPSC



# Chemical Repackaging and Distribution

## KEY ISSUES

- Mechanical Integrity
- Emergency Shutdown
- Emergency Response
- Public Notification



DPC Enterprises

Festus, MO (08/14/2002)



# Hazardous Waste Disposal Incident (36 injured; 14 public; 6 Firefighters)



Kaltech  
Industries  
Group  
Manhattan,  
NYC  
(04/25/2002)

## KEY ISSUES

Reactive hazards

Siting and Fire Codes

Hazard recognition and communication





# Chemical Processing Incident (minor injuries)



## KEY ISSUES

Reactive hazards

Siting of Buildings

Community Notification

First Chemical

Pascagoula, MS (10/13/2002)

# Improving Reactive Hazard Management - Conclusions

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1. Reactive incidents are a significant national safety problem, occurring wherever chemicals are stored, handled, or used.
2. Federal regs are inadequate: coverage, scope, incident tracking and public access.
3. Good reactive hazard management requires addressing chemical combinations under process-specific conditions.
4. Progress towards preventing reactive incidents requires enhanced regulatory and non-regulatory programs.





# Kletz's Inherently Safer Approaches

- Intensification
- Substitution
- Attenuation
- Limitations of Effects
- Simplification/Error Tolerance



# Layers of Protection Prevention Hierarchy

- Inherently safer design
- Basic controls, process alarms
- Critical alarms, operator supervision
- Automated action SIS or ESD
- Physical protection (relief devices, dikes)
- Plant emergency response
- Community emergency response



# September 21, 2001 Toulouse, France

## Key Facts

- $\text{NH}_4\text{NO}_3$  explosion
- 30 killed, some off-site 800 hospitalized, 2400 injured
- 3.4 on the Richter scale, 50 foot crater
- 500 homes uninhabitable; 85 schools damaged
- Releases and damages at other facilities
- Broad policy impact



AZF Agrochem Facility, Toulouse, FR



# Specialty Plastics Manufacturing (6 Deaths, 30+ injured)

## Key Issues

Community  
damage

Business continuity

Dust hazard  
recognition

NFPA Code  
awareness



West Pharmaceutical Kinston, NC (1/29/2003)





# Insulation Products Explosion and Fire (7 Deaths, 40+ injured, 10,000 jobs)

## KEY ISSUES

Combustible dust  
explosion

Hazard  
recognition

Cleaning practices

Code Awareness  
and adherence



CTA Acoustics

Corbin, KY (2/20/03)



# CSB on the Web

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[www.chemsafety.gov](http://www.chemsafety.gov)